of late years, but very little trustworthy experimental evidence has been hitherto forthcoming. M. Güntz now claims to have prepared the sub-fluoride Ag_2F, sub-chloride Ag_2Cl, sub-iodide Ag_2I, and sub-sulphide Ag_4S. The sub-fluoride, Ag_2F, was described by M. Güntz about a year ago. It was obtained in the form of a crystalline powder, resembling bronze filings in appearance, by the electrolysis of a saturated solution of silver fluoride by means of a very strong electric current. These crystals of the sub-fluoride are unalterable in dry air, but are more or less rapidly decomposed by moisture. Water itself effects the decomposition at once with evolution of heat, one equivalent of silver being precipitated, and one molecule of ordinary silver fluoride passing into solution. This well-defined crystalline salt serves for the preparation of the others. When dry hydrochloric acid gas is led over the sub-fluoride the latter rapidly changes, becoming coloured a deep violet tint, and gradually becoming converted into the sub-chloride, Ag_2Cl. The vapours of the chlorides of carbon, silicon, and phosphorus act very much better than hydrochloric acid, fluorides of carbon, silicon, or phosphorus, and comparatively pure sub-chloride of silver being produced. Similarly, by leading a current of gaseous hydriodic acid over the sub-fluoride, the sub-iodide, Ag_2I, is obtained, the reaction in this case being accompanied by a large rise of temperature. The sub-sulphide, Ag_4S, is also obtained in like manner by passing sulphuretted hydrogen over the sub-fluoride. It is of considerable interest, moreover, that if the sulphuretted hydrogen is replaced by water vapour, and the tube containing the sub-fluoride is heated to 160°, the sub-oxide itself, Ag_4O, is obtained as the product of the reaction. As regards the initial preparation of the sub-fluoride, it is somewhat important to note that if a weak current is employed, and the temperature of the saturated solution of silver fluoride prevented from rising, only metallic silver is deposited at the negative pole. But if, on the contrary, a very strong current is employed, such as will cause considerable heating effect, the bronze-like crystals of the sub-fluoride make their appearance. M. Güntz announces that he now proposes to compare his sub-salts thus prepared with the products of the action of light upon the normal salts, a comparison which can scarcely fail to lead to results of interest from a photographic standpoint.

THE additions to the Zoological Society's Gardens during the past week include a Sooty Mangabey (*Cercocebus fuliginosus* ♂) from West Africa, presented by Mr. F. J. Bennett; a Brown Howler (*Mycetes fuscus*) from Brazil, presented by Mr. E. Luxmore Marshall; an Azara's Agouti (*Dasyprocta azaræ*) from Brazil, presented by Lord Hebrand Russell, F.Z.S.; two Wild Swine (*Sus scrofa*) from Spain, presented by Mr. Alex. Williams; a Black-footed Penguin (*Spheniscus demersus*) from South Africa, a Rock-hopper Penguin (*Eudyptes chrysocome*) from the Falkland Islands, presented by Mr. H. B. Bingham; two Ring-necked Parrakeets (*Palæornis torquatus*) from India, presented by Miss E. Ogilvie; a Common Barn Owl (*Strix flammea*), British, presented by Mr. H. Bendelack Hewetson; a Common Fox (*Canis vulpes*), two White Pelicans (*Pelecanus onocrotalus*) from Southern Europe, deposited; an Egyptian Cat (*Felis chaus*) from North Africa, a Nankeen Night Heron (*Nycticorax caledonicus*) from Australia, a Great-billed Tern (*Phaethusa magnirostris*) from South America, purchased.

OUR PRESENT KNOWLEDGE OF THE HIMALAYAS.

THIS was the subject of an able paper read at Monday's meeting of the Royal Geographical Society, by Colonel H. C. B. Tanner (Indian Staff Corps), who for many years has been one of the officers of the Indian Survey, most of his time having been spent in various parts of the Himalayas from north-west to south-east. The paper was illustrated by a large number of admirable drawings by the author, which afforded an excellent idea of the physical and picturesque aspects of this great mountain system.

With regard to avalanches, Colonel Tanner stated that they play a great part in the conformation of the topography—a greater part, indeed, than is generally supposed, and this factor has not received the attention it deserves at the hands of geologists.

"I became acquainted," he said, "with four distinct kinds of avalanche, which, perhaps, are called by distinctive names by mountaineers, though I have been unable to ascertain them. The first, and the most common, is the precipitation of a mass of new snow from slopes which, from their steepness, are unable to retain more than a limited quantity of snow on them. They occur generally in winter and in early spring, and are the cause of the results just described. The second kind of avalanche is a descent of *old* snow, which is loosened by the heat of the sun. They may be heard throughout the summer and autumn, and are dangerous from the unexpected and irregular manner in which they slide off. The sportsman and traveller should guard against them by intelligently placing his camp in some sheltered spot out of their reach. This class is not usually of any great extent or weight, but such avalanches are of constant occurrence. The third kind can only be seen when the mountains are of peculiar formation or structure, and are really ice and not snow avalanches. They are of very constant occurrence in some localities, more particularly where small glaciers are situated high up on the crest of mountains, and are gradually pushed over the edge. In Lahaul, in the company of a friend, we watched the face of the well-known Gondla cliffs from the right bank of the Chandra River, and saw a number of these ice-falls, which came down every few minutes, filling the air with the noise of the loosened rocks and ice-blocks. The fourth kind of avalanche is one that I have only once seen, and have never known described. It is very curious, being the movements of billions of snowballs, which, in a stream a mile or half a mile long, I saw slowly wind down the upper part of an elevated valley in the Gilgit-Darel mountains. I was after ibex at the time of the occurrence, and was watching a herd of these animals, when I became aware of a low but distinct and unusual sound, produced by a great snake-like mass of snow winding down one of the valleys in my front. It occasionally stopped for a moment, and then proceeded again, and finally came to rest below me. I found this curious movement of snow was produced by countless numbers of snowballs, about the size of one's head, rolling over and over each other. The torrent-bed was full of them, an accumulation formed by numerous similar freaks of nature. I am quite unable to account for such an avalanche as the one now described. How does it originate, or by what process is the snow rolled up into these innumerable balls?"

Colonel Tanner made some interesting remarks on the subject of the line of perpetual snow. "Various authorities," he stated, "lay down such a line with great assurance, but for myself I find that circumstances of position, of climate, and of latitude, play so great a part in the position of this line that I am unable to define it even approximately. No sooner in one locality, or during one particular season, have I settled, to my own satisfaction, the line of perpetual snow, than I presently have been obliged completely to modify my views on the subject. On p. 154 of the 'English Cyclopædia,' vol. v., I read that snow lies 4000 feet higher in the northern than in the southern side of the Himalayas. On p. 281, vol. x., of the same work, it is stated that the snow-line on the northern slope is at 19,000 feet, which I should have been inclined to say is 1500 or 2000 feet too high. In Gilgit, during the end of summer, I found masses and fields of snow at 17,200 feet, and they extended down the northern slope certainly 2000 feet or even more below that altitude. In Kulu, which has many degrees of latitude less than that of Gilgit, avalanche snow lies in valleys above 8000 feet throughout the year after a good winter snowfall, but during the past spring, following a very mild winter, I found no snow at all at 8000 feet. There had been no avalanches, and even in June, at 14,000 feet, snow lay only in patches. I think that, in determining the snow-line with greater precision than has been done hitherto, scientific men should ascertain those altitudes on which perpetual snow lies on flat places in the position where it first falls, and should neglect the occurrence of a snow-field where it may have been protected from the sun's rays by its occurrence on the north face of a mountain. From memory I can state that there are a considerable number of typical localities which would help out such an inquiry. There is a peak (without name) about thirty miles north of Gilgit, with rounded summit, which, though only 17,500 feet high, is covered with a cap of perpetual snow."

Speaking of the Himalayan glaciers, Colonel Tanner stated that the most extensive and the most picturesque he has seen are in the Sat valley, which drains the southern face of Rakaposhi mountain in Gilgit. Three great glaciers come down into this valley, and dispute with the hardy mountaineers for the possession of the scanty area of the soil. Here may be seen forests, fields, orchards, and inhabited houses all scattered about near the ice heaps. The only passable route to the upper villages in this valley crosses the nose of the greatest of the three glaciers, and threads its way over its frozen surface. This glacier is cut up into fantastic needles of pure green ice, some of which bear on their summits immense boulders. About half a mile from its lower end or nose, Colonel Tanner found an island bearing trees and bushes, and at one place above this a very considerable tarn of deep blue-green water. The glacier had two moraines parallel with each other, and both bearing pine-trees; and from the highest point Colonel Tanner reached he fancied he saw the ice emerging from the *névé* at its source, far away up the slopes of Rakaposhi. In this glacier the pinnacles, wedges, blocks, and needles of ice were of the most extraordinary appearance, and the whole formed a weird and impressive view which he can never forget. Though the largest glacier Colonel Tanner has ever approached, it is very small indeed when compared with those described by Colonel Godwin-Austen in a locality not very far from the Sat valley. Insignificant though it is, it was more than Colonel Tanner could take in during his visit of two days' duration. It struck him at the time of his inspection that the peculiar stratified appearance of the ice needles, which in the case of the Sat glacier is very strongly marked, must have been caused by the different falls of avalanche snow on the bed of *névé* at the source of the glacier.

The lowest glacier Colonel Tanner has seen in the Himalayas is one that reaches the foot of the range near Chaprot Fort in lat. 35½°, in Gilgit. It is formed of beautiful clear ice and has no dirt. In Kulu and Labaul, lat. 32°, glaciers do not come down below 12,000 or 13,000 feet, and all are very dirty; and in Sikkim, lat. 28° or 29°, without having visited the glacier region himself, Colonel Tanner would say that the lowest limit reached by the Kinchinjanga group must be considerably higher, perhaps by 2000 feet or even more. The smallest mountain he has ever met with capable of giving rise to a glacier, is one on the Gilgit-Dareyl range, whose height is 17,200 feet, and in this case the mass of ice formed is of very inconsiderable size. Of the glaciers round Mount Everest and its great neighbours we know next to nothing, and the little we have learnt is derived from the itineraries of native explorers, who, of all classes of travellers, seem the least capable of furnishing trustworthy information regarding any subject lying at all outside their actual angular and distance measurements. But with his telescope, when employed on the survey of the Nipal boundary, Colonel Tanner has gazed long and earnestly at the icy region at the foot of Everest, and Peak No. XIII., where the glaciers extend over a very large area.

With regard to our actual knowledge of the Himalayas, Colonel Tanner thinks that perhaps our botanical knowledge is far ahead of other branches of science. Many eminent botanists have been at work for a long time past, and of late Dr. Duthie has been allowed to travel on duty into tracts not before visited by anyone possessing the requisite knowledge. It is likely that Dr. Duthie's museum at Saharunpur will, within a moderately short time, become an almost complete depository of the chief vegetable products of the Himalayas. The geologists, Messrs. Blandford, Edwin Austen, Richard Strachey, Stolitzka, and Lydekker, have been pretty well over those tracts open to Europeans, and are now well acquainted with all the leading features of their branch of science presented by the mountains of Kashmir, Kumaon, Kangra, and Sikkim. Ornithology has found many votaries, and the birds of these mountains are now probably all or nearly all known, though the late Captain Harman, only a few years back, discovered a new and handsome pheasant in the extreme eastern end, either of Bhutan or Tibet. The mammals, Colonel Tanner supposes, are all known, though one, at least, the Shao, or great stag of Tibet, has not yet even been seen by any European, and the famous *Ovis poli* has been shot by not more than two or three sportsmen.

With regard to the work of the Survey, Colonel Tanner stated that the maps of Kashmir and Gilgit, without being free from error, are of the greatest use to a large class of officials. Incomplete though they may be, they were not brought up to their present state without taxing to the utmost the endurance of a hardy set of men. Adjoining Kashmir to the eastwards comes Kangra, with its subdivisions of Kulu, Lahaul, and Spiti. Kangra had once been roughly surveyed prior to the arrival there of Colonel Tanner's party, who are now at work on a very elaborate contoured map, which will take a long time to complete, owing to the intricacy of the detail demanded. Between Kangra and Kumaon occur various native States whose territories are being surveyed on the scale of 2 inches to 1 mile, also contoured work, resulting in very elaborate and trustworthy, though somewhat expensive, maps. Eastward of Kumaon, Nipal stretches along our border for some 500 miles till Sikkim is reached, and eastward again of Sikkim comes Bhutan, and various little-known semi-independent states which lie on the right bank of the Sanpo River. Nipal marches with the Kumaon border for many miles, and advantage was taken of the existence of the trigonometrical stations on the Kumaon hills to extend our knowledge of the adjacent topography of Nipal, and this was done about four years ago with some little result. The more prominent peaks in Nipal within a distance of about 100 miles were fixed trigonometrically, and some slight topographical sketching was done. From the trigonometrical stations near the foot of the lower hills, both in the North-West Provinces and in Bengal, trigonometrical points have lately been fixed, and some distant sketching done in Nipal, for 500 miles between Kumaon on the western and Sikkim on the eastern extremity of this kingdom; and, again, from the trigonometrical hill stations along the western boundary of Sikkim more points and hazy topography of Nipal was secured. This very meagre topography, sketched from very great distances, comprises all the geography of Nipal other than the sparse work collected by Colonel Montgomerie's explorers, or by explorers trained to his system who have worked since his death. All the existing data, whether trigonometrical, distant sketching, or native explorers' routes, are now being combined, as far as the often conflicting and contradictory materials admit. The resulting map of the country, though at most little better than none, is all we have to expect until some of the strictures on travelling in Nipal are lessened by the Nipal Government.

The whole of the Nipalese border, which marches with British territory for some 800 miles, is jealously guarded, and no European is allowed to cross it, except when the Resident of Kashmir or his own personal friends are permitted to proceed by a certain and particular route, between the military station of Segowli and Katmandu. Sikkim flanks the eastern boundary of Nipal, and the, until lately, indefinite western boundary of Shutan. British Sikkim is a small tract, which has twice been surveyed on suitably large scales. Independent Sikkim, which contains Kinchinjangee, one of the highest mountains, and some famous passes—the Donkhya, visited by Sir Joseph Hooker and a few others; and the Jelap, where our forces, under General Graham, have lately been employed, was surveyed in reconnaissance style by Mr. Robert, an energetic and hardy assistant of the Survey of India Department. The sketch map obtained by this gentleman is complete, and similar in character to that of Gilgit by Colonel Tanner, and to that of Nari Khorsam and Hundes by Mr. Ryall. It does not pretend to any exhaustive detail.

Our knowledge of Bhutan, or, rather, our ignorance of it, is about on a par with that of Nipal, but in Bhutan we have the valuable information left by Captain Pemberton, who forty-three years ago traversed the greater portion of the country from west to east. Besides Pemberton's work, Colonel Godwin-Austen, while he accompanied Sir Ashley Eden's mission to the court of the Deb Raja in the year 1863, executed a route survey in Western Bhutan. The engineer officers who were attached to the military force at Pewangiri also did some little topographical sketching, and beyond this we have distant sketching and trigonometrical work, as in Nipal, which, also, has yet to be combined with the route surveys of native explorers, some rather recent, and some of greater date. The difficulties which are presented to further researches in the direction of Bhutan geography seem unlikely to diminish. Our knowledge, then, of Bhutan is as unsatisfactory as that of Nipal. Eastward of Bhutan occur those numerous semi-independent hill States who sometimes, when necessity presses, own allegiance to Tibet, and at others assert their complete freedom from control. Colonel

Tanner himself has sent in two maps of this region derived from native sources, and both upset maps previously accepted, and it is highly improbable that we have any but the most rudimentary and vague knowledge of the course of the Sanpo below Gyala Sindong, and not even that of the course or limits drained by the Dibong. Colonel Tanner then referred in some detail to the great rivers that have their sources in the Himalayas, and concluded by giving some advice to tourists as to the best routes to take.

SCIENTIFIC SERIALS.

The numbers of the *Journal of Botany* for February, March, and April, do not contain many articles of interest to those not concerned with systematic botany. Miss Barton has an interesting note on the occurrence of structures which have the appearance of galls on a common red seaweed, *Rhodymenia palmata*. Very few examples of this phenomenon have hitherto been described in connection with Algæ. Messrs. Britten and Boulger's biographical index of British and Irish (*sic*) botanists is now nearly completed, and we are glad to see that the editor of the *Journal* has not yet abandoned the idea of reprinting it in a separate form.

In the *Botanical Gazette* for February, Dr. D. H. Campbell continues his useful series of papers on the histology of the higher Cryptogams, with a note on the apical growth of *Osmunda* and *Botrychium*, in which he shows the large range of variation on this point within the Osmundaceæ.—In the March number, Mr. G. F. Atkinson discourses on the black rust of cotton, a disease due to the attacks of several parasitic fungi, of which the most destructive is *Cercospora Gossypina*.

SOCIETIES AND ACADEMIES.

London.

Physical Society, April 17.—Prof. W. E. Ayrton, F.R.S., President, in the chair.—The following communications were made:—On a property of magnetic shunts, by Prof. S. P. Thompson. After referring to a few instances in which magnetic shunts are employed, as, for example, the ordinary magnetic medical coil, and Trotter's constant current dynamo, he said that the particular property he wished to speak of was the time taken for such a shunt to lose its magnetism, as compared with the other branch of the magnetic circuit. If these times were very different, unexpected results might be produced, and these might be regarded as being due to a kind of magnetic time-constants. Short pieces, as was well known, demagnetize much more rapidly than long ones, particularly if the latter form, or be part of, a closed magnetic circuit. Hence, in alternators, such as Kingdon's keeper dynamo, in which both magnets and armature are stationary, it was important that the revolving keepers should be short. The most important application of a magnetic shunt occurred, he said, in D'Arlincourt's relay, described in vol. iv. of the Journal of the Society of Telegraph Engineers and Electricians, and shown diagrammatically in the figure. In this relay the polarized tongue T plays between two projections, *a* and *b*, near the yoke Y, and it is claimed to have a quicker action than ordinary kinds. The reason of this the author explained as follows. When a current flows through the coils, the greater part of the magnetic lines pass through the yoke, but a few leak across from *a* to *b*, and move the tongue against the contact P. On stopping the current, the magnetism in the extremities A and B dies away much more rapidly than in the yoke; consequently, the direction of the field between *a* and *b* is reversed, and the tongue T thrown back against the stop Q. Prof. Perry asked if any experiments had been made to test whether the throwing back actually occurred. He also inquired whether such action would be augmented, or otherwise, by having a thick copper tube round the yoke, or by laminating the iron. Mr. Blakesley asked if placing a yoke across A B would not improve the action. The President said he would be glad to know whether the relay was any more sensitive than an ordinary one as regards the ampere-turns or the watts required to actuate the instrument. In India, he remembered that they used inductive coils shunting the ordinary relays, in order to expedite the action and to avoid confused signals arising from the electrostatic capacity of long lines. In reply, Prof. Thompson said he had tried an experiment on a horseshoe electromagnet, and found evidence of throwing back when working near the bend or yoke. Putting a yoke across A B would, he thought, tend to neutralize the effect desired.—An alternating current influence machine, by James Wimshurst. This machine consists of a varnished glass disk, with or without metallic sectors, mounted on an axis, and rotating within a square wooden frame fixed in the plane of the disk. The frame carries four square glass plates, each of which has one corner cut away so as to clear the boss of the disk. These plates are placed one at each corner of the frame, alternately on the two sides, and the disk revolves between them. There are thus two plates on one side of the disk situated at opposite ends of a diagonal of the frame, and two on the other side of the disk, at opposite ends of the other diagonal. Tin-foil sectors fixed to the outer sides of the plates act as inductors, and wire brushes connected with them touch the disk about 90° behind the centre of the inductors. The peculiarity of the machine is that, although sparks can be readily obtained from it, a Leyden jar cannot be charged by bringing it to one of the terminals. From this the author concluded that the electricity produced was alternately of positive and negative sign, and this he showed to be the case by means of an electroscope. The alternations, he said, occurred about every three-quarters of a revolution, the suspended paper disks which he used as an electroscope remaining apart for that period and collapsing during the next quarter of a turn. Using disks with various numbers and sizes of sectors, the author finds that the smaller the sectors and the fewer the number the greater the quantity of electricity produced. Plain varnished glass is the best in this respect. Such a disk, however, does not excite itself quite so freely as one having numerous metallic sectors. By removing two of the inductors and placing an insulating rod carrying collecting brushes at its ends, across a diameter of the disk, the machine was used to produce direct currents. Numerous disks and various shaped inductors accompanied the machine, by means of which a Holtz, Voss, or ordinary influence machine could be imitated. Prof. S. P. Thompson congratulated the author on the most interesting and puzzling machine he had brought before the Society. He inquired if the machine would work if the direction of rotation was reversed, or if two of the inductors were removed, and also whether all the four inductors are electrically of the same sign at the same instant. In reply, Mr. Wimshurst said the machine would not excite if the direction of rotation be changed without also changing the direction of the brush arm, but it would work as a direct current machine when two inductors were removed.—On erecting prisms for the optical lantern, and on a new form of erecting prism made by Mr. Ahrens, by Prof. S. P. Thompson. The ordinary form of erecting prism, viz. a right-angled isosceles one, was, the author pointed out, open to the objection that the top halves of the faces inclosing the right angle were nearly useless, for only the light which, after the first refraction is totally reflected by the hypotenuse face, can be utilized. The fraction of the side which is useful varies with the refractive index, being 0·46 when $\mu = 1{\cdot}5$, and 0·525 when $\mu = 1{\cdot}65$. To increase these proportions, prisms with angles of 105° and 126° have been used by Wright and others, and in some cases the prisms have been truncated. With such large angles, much light is lost by reflection. Bertin employed two truncated right-angled prisms placed base to base with an air-film between them. Nachet has also